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Early Electrical Experiences

By W. A. GALLOWAY, '30

Professor W. A. Knight of the Department of the Industrial Engineering gave some of his personal experiences in electrical manufacturing at a recent meeting of the A. I. E. E. Some of these experiences date back to a time when Columbus had only a few electric lights in the downtown district. Professor Knight was first affiliated with the University in 1893. At that date and for some time afterward he sold generator sets to the early electrical experimenters.

One of his first power-driven devices obtained its motive power from a clockwork. This machine, of course, ran down quickly and because of this feature was not very desirable. A friend in a joking way suggested that what he needed was a perpetual motion machine. Acting on this tip, he built several of these machines but none of them would work. One of these machines had a set of permanent magnets as its motive power, but even this would not work.

In the midst of all the work on perpetual motion contrivances, Professor Knight came into possession of a copy of Gage's *Physics*. He had a lot of trouble trying to understand why a man standing still holding up a weight was doing no work, and why action and reaction were always equal. Finally, all these things were straightened out in the Professor's mind and he built an electric motor and connected it to a fan. This fan was run by batteries located in a room above. This electric fan was no doubt the first of its kind in Columbus if not any place.

Soon after building the fan, Professor Knight left the Union Station where he was employed as an engineer and went to work in a machine shop which was outside the range of the downtown electric plant of the old Thompson, Houston Co. In this shop work was carried on by the use of gas lights in the form of a flame shooting out like a bunsen burner. The foreman of the shop asked Knight to build an electric lighting machine that would be capable of lighting about twenty lamps. When the machine was built and tested, the armature was full of short circuits and would not operate successfully. Professor Thomas at the university was consulted and told them that cast iron was no good for generator construction. The machine was rebuilt using metal discs and was finally operated. After many adjustments, the

capacity was brought up to twenty lights. The shop was wired up using wooden cleats and rosettes. This shop was the first of its kind to be electrically lighted and was a show place for the people of the surrounding country.

The Nelsonville Foundry and Machine Company wanted a machine to light their shops and Professor Knight engineered the building of it. It was a shunt wound generator and worked fairly well in spite of the fact that the copper brushes on the commutator threw sparks nearly three inches long. On the day the machine was to begin its work, a crowd collected at a safe distance to watch the proceedings. Some of the people predicted that the apparatus would draw lightning and cause all sorts of trouble but the generator worked just the same and the new lights

were much better than the old gas torches. Several similar dynamos were supplied to different companies and according to Professor Knight the mechanical and electrical construction was even at that early date equal to the present-day machines.

The next product to be worked on was an electric tricycle. This device was ordered by a "well-to-do" member of the church for his pastor. It had a three-eighths horsepower motor driven by batteries. The completed vehicle had one battery in front and two behind. The first trial was made with wire wheels on the tricycle and as the load was too great, they broke down when turning a corner and spilled glass and acid all over the street. Professor Knight returned to the shop and had a man go out and haul the wreckage back in a wheel-barrow. After wooden wheels had

been installed, the tricycle ran fairly well.

Having had success with series and shunt wound generators, he next built two compound machines to work together in the same plant. He had heard and read quite a bit about their property of load shifting and formulated an idea whereby half the field of one machine could be thrown over on the other in case they were not operating well. The plan was tested, but the lights gradually died down and went out. The wiring was carefully checked and no mistake was found. Professor Knight says he can not to this day understand why this plan failed. The two

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Fac-simile of an early dynamo pamphlet

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machines were afterward operated successfully in the regular manner.

Electrical instruments in those days were crude affairs and the volt and ammeter had uneven scales. Professor Knight wanted one that had an even scale and built both volt meters and ammeters reading evenly over the whole scale. Another device used in building his generators was a piece of apparatus used for testing the permeability of iron. A test piece of the iron to be used was subjected to magnetization in an electro-magnet wound on a piece of hollow brass tubing, and then brought near a permanent magnet which in turn worked a needle over a graduated scale. This test gave the necessary information on the magnetic properties of the sample.

The brushes used on these early machines were made from copper strips. Professor Knight had the idea that graphite would make an ideal brush. He prepared a set of these and tested them on a generator of his at the Anderson Paper Mill on Mound Street. They worked fine to start with, but hardly had he arrived back at the shop when a call came to inform him that the dynamo was acting up. Carbon brushes were brought out shortly after this and efforts in this direction ceased.

Professor Knight thought that electric lamps could be made from carbon filaments imbedded in a solid glass form. Several such lamps were made. The carbon filaments were made from a thread dipped in sulphuric acid to enable them to carbonize into a plastic form. He succeeded at last in getting a heavy piece of glass around this carbon filament and tested the resulting lamp. All such

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tests were made with the lamps enclosed in a heavy wire net box, for the minute the current was turned on the lamp would blow up and throw glass all about.

He later experimented with a motor designed to operate without a commutator when the first trolley line in the city was built on Chittenden Avenue to the fair grounds. This motor was rebuilt twice, but it wouldn't function. An Ohio State graduate, Mr. Short, who was working for the trolley company was consulted about the motor and with his help the trouble was ironed out. Up to this time the idea was held that the magnetic pull was on the iron magnet cores instead of the wires themselves.

At this stage the electrical field was very similar to the present-day radio fad only with the exception that it was absolutely new. Professor Knight manufactured sets of parts for an eight-light dynamo and sold them complete with a set of blueprints for eight dollars. He advertised in the *Scientific American* and sold electrical supplies in the form of sockets, wire lamps, etc. Professor Knight was a true pioneer in the game and is worthy of recognition for this early work.

W. A. GALLOWAY, '30.

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